S.R. 66 Storm Sewer Project

Tunnel Design and Construction
by
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Overview of Presentation

- Tunnel design concepts
- SR-66 design issues
- Tunnel components and construction

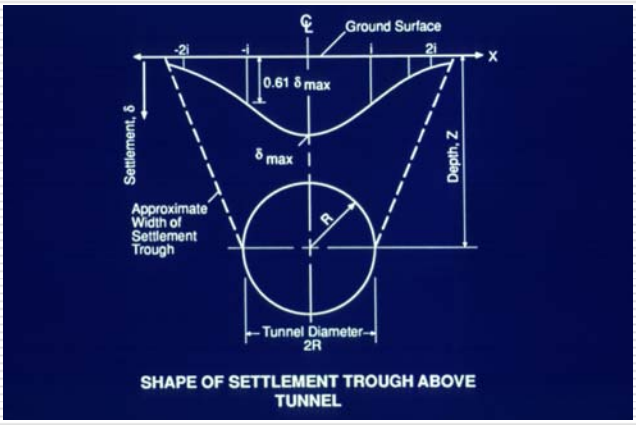
Tunnel Design Concepts

- Matching equipment, methods, and materials to ground conditions
  - Tunneling Machine
  - Initial Support
  - Final Lining
- Satisfy project goals
- Avoid disasters
- Economical

Design and Construction Considerations

- Utilities
- Third party impacts
  - Settlement
  - Traffic
  - Businesses
- Muck disposal
- Settlement
- Staging area(s)

Ground Settlement



SHAPE OF SETTLEMENT TROUGH ABOVE TUNNEL

Ground Conditions & Behavior

- Sand below water Table: Flowing ground
- Clean sand above water: Running ground
- Dirty sand: Raveling ground
- Hard clay: Firm ground
- Soft clay: Squeezing ground
- Combinations are common

Construction Overview

- Shafts
- Tunnel Excavation and Support
- Pipe Installation
- Backfill Annulus and Contact Grout
- Clean Up

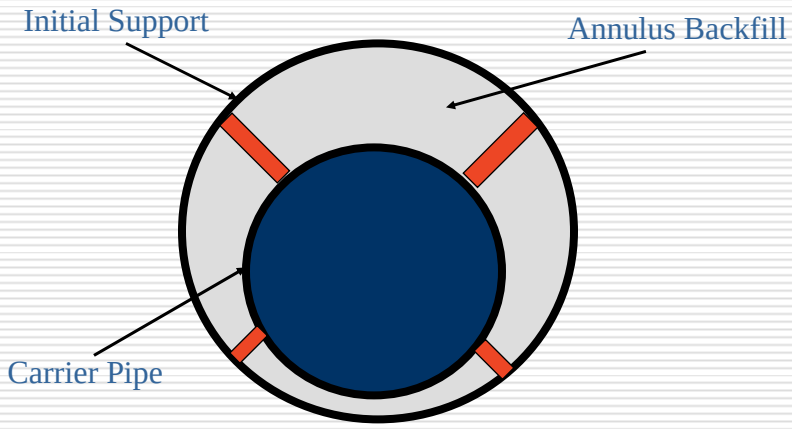
Shafts

- Access shaft - main work area
- Generally 0.5-2 acres required for staging
- Access shaft size depends on pipe diameter and length
- Must balance access shaft size between contractor needs/wants and costs
- Exit shafts are smaller than access shafts

Tunnel Excavation and Support

- Tailor excavation and support methods to the ground
- Must control loss of ground
- One-pass or Two-pass method
- Positive face control or open face
- Different methods better for different ground conditions

Two-Pass Tunnel



Circular Shield with Doors

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Soft Ground Rotating Tunnel Head

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Earth Pressure Balance Machine

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Potential Problems

- Broken Utilities
- Surface settlement/sinkhole
- Settlement of nearby foundations
- Poor pipe connections (leaks)
- Noise complaints
- Traffic congestion

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SR-66 Design Issues

- No open cut
- No shafts along SR-66 in this phase – no manholes, pipe jacking not allowed
- Earth Pressure Balance Machine (EPB) to control soils beneath the water table
- Control settlement of roadway, utilities, and pedestrian bridge

SR-66 Contract Documents

- Data Report
- Geotechnical Baseline Report
- Specifications – combination of prescriptive and performance requirements
- Drawings
- Overall approach – allowed as many methods as possible

Specifications

- Dewatering and water control
- Shaft excavation and support
- Tunnel boring machines
- Tunnel excavation and initial support
- Contact grouting
- Tunnel final lining
- Geotechnical instrumentation
- Reinforced concrete pipe
- Low density cellular concrete

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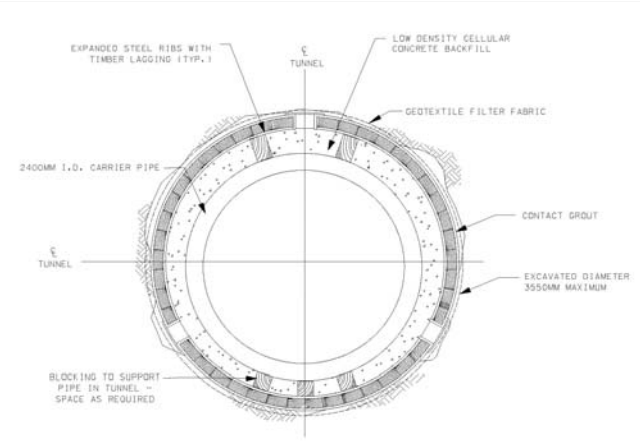
Tunnel Cross Section



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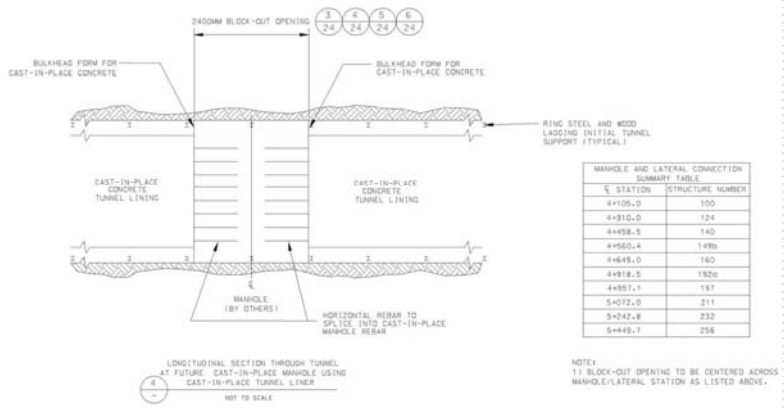
Block Outs



MANHOLE AND LATERAL CONNECTION SUMMARY TABLE	
℄ STATION	STRUCTURE NUMBER
4+106.0	100
4+310.0	124
4+458.5	140
4+560.4	149b
4+649.0	160
4+918.5	192a
4+957.1	197
5+072.0	211
5+242.8	232
5+449.7	256

NOTE:
1) BLOCK-OUT OPENING TO BE CENTERED ACROSS MANHOLE/LATERAL STATION AS LISTED ABOVE.

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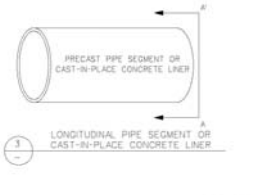
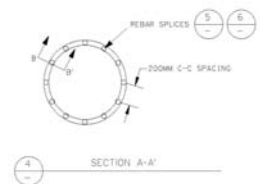
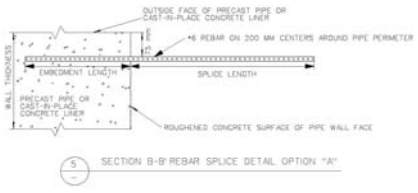
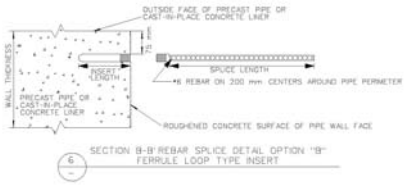
Pipe Block Outs









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Existing Pump Station

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Staging Area

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Staging Area

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Tunnel Supports

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Access Shaft

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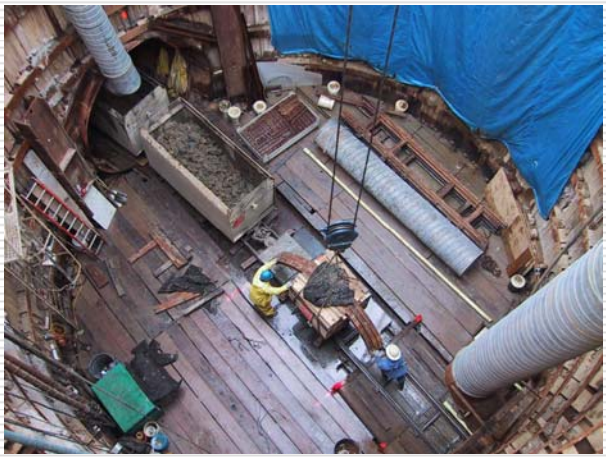
Access Shaft Layout



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Access Shaft

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Tunnel Heading

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Set of Tunnel Supports

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Tail Tunnel

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Block-Out in Tunnel

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Special Pipe at Block-Out

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Pipe at Plant

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Precast Pipe

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Lowering Pipe into Shaft

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Pipe Placement Using Carrier

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Questions?